Claims

A computer-assisted method for determining a dimension of an anatomical feature using two or more fluoroscopic images, the method comprising:

displaying a first fluoroscopic image taken of an anatomical feature taken from a first pose, the first image being registered to a common three-dimensional coordinate system;

receiving indication of position of at least a first point and a second point within first image corresponding respectively to at least two anatomical landmarks shown within first image;

displaying a second fluoroscopic image taken of the anatomical feature from a second angle, the second image being registered to the known three-dimensional coordinate system;

indicating with reference to the second image where the anatomical landmarks lie along each of two lines of sight defined by the first and second points within the three-dimensional coordinate system; and

determining distance of a line specified by the first and second points.

2. The method of claim 1, further comprising:

placing within the field of view of each fluoroscopic image a plurality of fiducials having known positions with respect to each other;

receiving an input to identify two-dimensional coordinates of each of the plurality of fiducials displayed on each of the images; and

registering the images by creating a geometric model having parameters, said model projecting three-dimensional coordinates of the plurality of fiducials into the identified coordinates of the fiducials on the images, and numerically optimizing the parameters of the geometric model such that the projections of the known three-dimensional coordinates of the fiducials best fit the identified two-dimensional coordinates in each of the images.

3. The method of claim 1 wherein the lines of site are indicated on the second image by lines drawn on the second image.

4. An apparatus for determining a dimension of an anatomical feature using two or more fluoroscopic images, comprising:

means for displaying a first fluoroscopic image taken of an anatomical feature taken from a first pose, the first image being registered to a common three-dimensional coordinate system;

means for receiving indication of position of at least a first point and a second point within first image corresponding respectively to at least two anatomical landmarks shown within first image;

means for displaying a second fluoroscopic image taken of the anatomical feature from a second angle, the second image being registered to the known three-dimensional coordinate system;

means for indicating with reference to the second image where the anatomical landmarks lie along each of two lines of sight defined by the first and second points within the three-dimensional coordinate system; and

means for determining distance of a line specified by the first and second points.

5. A computer readable storage medium on which is recorded program instructions that, when read and executed by a computer, cause the computer to undertake the following steps:

displaying a first fluoroscopic image taken of an anatomical feature taken from a first pose, the first image being registered to a common three-dimensional coordinate system;

receiving indication of position of at least a first point and a second point within first image corresponding respectively to at least two anatomical landmarks shown within first image;

displaying a second fluoroscopic image taken of the anatomical feature from a second angle, the second image being registered to the known three-dimensional coordinate system;

indicating with reference to the second image where the anatomical landmarks lie along each of two lines of sight defined by the first and second points within the three-dimensional coordinate system; and

determining distance of a line specified by the first and second points.

6. A computer based method for determine a correct size or shape of a surgical object for implanting in a patient, comprising:

displaying a first fluoroscopic image taken of an anatomical feature taken from a first pose, the first image being registered to a common three-dimensional coordinate system;

receiving indication of position within first image of a projected surgical object corresponding to a three-dimensional virtual object, the virtual surgical object being defined with reference to the common three-dimensional coordinate system and having one or more attributes corresponding to one more physical characteristics of a surgical object to be implanted in the patient;

displaying a second fluoroscopic image taken of the anatomical feature from a second angle, the second image being registered to the known three-dimensional coordinate system;

drawing on the first and second fluoroscopic images two dimensional projections of the virtual surgical object; and

updating on the projection of the virtual surgical object in the first image in response to a user manipulating the projection of the virtual surgical object in the second image.

7. The method of Claim 6 wherein manipulating the projection of the virtual surgical object includes moving the projection to a point where it best aligns with an anatomical feature shown in the image.

8. The method of Claim 6 wherein manipulating the projection of the virtual surgical object includes modifying a dimension of the virtual surgical object to align the projection with an anatomical feature in shown in the image.

9. The method of Claim 6 wherein the virtual surgical object represents a stent and manipulating the projection of the virtual surgical object includes moving the projection of the virtual surgical object to a position where it overlays in the image an artery into which a stent will be implanted.

10. A computer readable storage medium on which is recorded program instructions that, when read and executed by a computer, cause the computer to undertake the following steps:

displaying a first fluoroscopic image taken of an anatomical feature taken from a first pose, the first image being registered to a common three-dimensional coordinate system;

receiving indication of position within first image of a projected surgical object corresponding to a three-dimensional virtual object, the virtual surgical object being defined with reference to the common three-dimensional coordinate system and having one or more attributes corresponding to one more physical characteristics of a surgical object to be implanted in the patient;

displaying a second fluoroscopic image taken of the anatomical feature from a second angle, the second image being registered to the known three-dimensional coordinate system;

drawing on the first and second fluoroscopic images two dimensional projections of the virtual surgical object; and

updating on the projection of the virtual surgical object in the first image in response to a user manipulating the projection of the virtual surgical object in the second image.